

**METHODS AND DEVICES FOR DETECTING AND CANCELING**  
**MAGNETIC FIELDS EXTERNAL TO A CHARGED-PARTICLE-BEAM**  
**(CPB) OPTICAL SYSTEM, AND CPB MICROLITHOGRAPHY**  
**APPARATUS AND METHODS COMPRISING SAME**

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**Abstract of the Disclosure**

CPB microlithography systems are disclosed that effectively cancel the effects of floating external magnetic fields and that exhibit a high magnetic shielding ratio using small components. An exemplary system includes a search coil situated and configured to detect external magnetic field, and a compensation coil situated and configured to produce a magnetic field that, based on the detected magnetic field, cancels the external magnetic field. These coils desirably are situated downstream of an illumination lens. The external magnetic field detected by the search coil is converted to a corresponding electrical signal by an external-magnetic-field-detection circuit and routed to an external-magnetic-field-compensation circuit to which the compensation coil is connected. The external-magnetic-field-compensation circuit cancels the external magnetic field by providing an electrical current, corresponding to the detected external magnetic field, to the compensation coil. A search coil and compensation coil also can be provided in a similar manner downstream of a second projection lens, and provided with a respective external-magnetic-field-detection circuit and external-magnetic-field-compensation circuit.

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